

THE WOOD & PEDAL CAR

A Four-Person Car That Runs on Nothing but Leg Power

No battery. No engine. No fuel. No steel frame. Just wood, pedals, and people.

What is this?

Four people sit inside a lightweight wooden car. Everyone pedals. The pedaling directly turns the wheels — like a giant bicycle built for four. To stop, you back-pedal or press a simple foot brake. That's it. No electricity. No motor. No complicated parts. This study explains exactly how to build it and what to expect from it.

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1. THE BIG IDEA

Imagine four people sitting together inside a car-shaped wooden shell. Instead of an engine or a battery, each person has a set of pedals in front of them — like a bicycle. When everyone pedals together, the car moves. When they stop pedaling, it slows down. A simple foot brake stops it completely.

The car is built mostly from wood — a material that is light, strong, cheap, easy to shape, and available almost everywhere. The wheels, pedal parts, chains, and brakes come from bicycle shops. Nothing here needs a factory or special equipment to build or fix.

The one rule

Every moving part must be something a bicycle mechanic can understand, buy, and fix with normal tools. No electronics. No welding. No battery. If something breaks, you fix it with a spanner and a spare part from a cycle shop.

2. HOW IT MOVES — PEDAL TO WHEEL

The idea is simple. Each person's pedals turn a small sprocket. A chain connects that sprocket to a bigger central shaft that runs across the middle of the car. That central shaft is connected — again by chain — to the rear axle. The rear wheels sit on the axle. When the axle turns, the car moves forward.

Think of it like a tandem bicycle, but wider, with four riders side by side (two in front, two in back), all connected to the same rear axle.

How the pedal force travels

Step	What happens	Like this on a bicycle
1	You push the pedal down	Same as any bike
2	The pedal turns a round gear (chainring)	Same as any bike
3	A chain carries that turning force to the central shaft	Like a single-speed bike chain
4	The central shaft turns the rear axle	Like a fixed-gear bike
5	The rear axle spins the rear wheels	The wheel turns, the car moves

One-way pedaling

Each rider's pedals have a ratchet built in (a freewheel — the same thing that lets you coast on a bicycle without back-pedaling). This means one person can rest and the other three keep going. The resting person's pedals simply spin free without dragging on the others.

3. HOW IT STOPS — BRAKING

There are two ways to slow down and stop this car. Both are simple and use parts you can buy at any bicycle shop.

Method 1 — Foot brake pads (main brake)

The driver presses a foot pedal that squeezes rubber brake pads against the inside of all four wheels — like the handbrakes on a bicycle but operated by foot. This is the primary way to stop. It works at any speed and in wet conditions.

Method 2 — Back-pedaling (gentle slowdown)

Because the rear wheels are connected directly to the pedal shaft, pedaling backwards creates resistance and slows the car gently. This is useful for small speed reductions — like coming up to a junction slowly. It does not stop the car completely on its own.

Safety rule

The foot brake is always the main way to stop. Back-pedaling alone is not enough in an emergency. The foot brake must always be in working order before the car is used.

4. THE FRAME — BUILT FROM WOOD

The frame is the skeleton of the car. In this design, it is made from hardwood — the same kind of dense, strong timber used in furniture and traditional boat building. No steel welding. No expensive metal fabrication. Just wood cut to size, bolted and glued together.

Why wood works here

- Wood is light. A well-built wooden frame for this car weighs around 35–45 kg — light enough that four people can lift the empty shell.
- Wood is stiff. Hardwood beams resist bending well at the low speeds this car travels (15–25 km/h).
- Wood is easy to repair. A cracked joint can be re-glued. A broken beam can be replaced with a saw and a drill.
- Wood is cheap. Compared to steel fabrication or carbon fibre, timber costs a fraction of the price.
- Wood absorbs vibration. It gives a slightly softer, quieter ride than a metal frame.

Frame layout

Main floor beams	Two long beams running front to back, 50 × 100 mm hardwood, full length of the car
Cross beams	Five cross-pieces connecting the two main beams, forming a ladder shape underneath
Seat rails	Four sets of short rails bolted onto the cross beams, one for each rider
Roof arch	A gentle curve of bent plywood above the riders, for weather cover
Side panels	3 mm marine plywood sheets, glued and screwed to the frame for rigidity and weather protection
Floor panel	12 mm plywood, forms the base on which riders sit and pedal
Joints	Hardwood corner blocks, waterproof wood glue, and 8 mm bolts — no welding at all
Surface finish	Exterior wood varnish, two coats, for weather protection

Wood choice

Use teak, ash, or seasoned eucalyptus. Avoid pine — it is too soft and splits under load. Marine plywood for all sheet panels — it resists moisture far better than regular plywood.

5. SIZE & LAYOUT

The car is sized to comfortably seat four adults — two at the front, two at the back — each with their own pedals and enough leg room to pedal properly.

Dimension	Size	Why
Total length	2,800 mm (2.8 m)	Two rows of two riders with leg room
Total width	1,400 mm (1.4 m)	Two adults side by side with a small gap
Height (floor to roof)	1,200 mm	Seated headroom for riders up to 1.85 m tall
Wheelbase (front to rear axle)	1,900 mm	Stability at speed, keeps the car balanced
Track width (left to right wheel)	1,200 mm	Prevents tipping when turning
Ground clearance	150 mm	Clears road bumps and kerbs
Seat height from floor	350 mm	Comfortable pedaling angle for most adults
Seat spacing (front to back row)	950 mm	Full leg extension for rear riders

6. WHEELS, AXLES & STEERING

Wheels

The car uses four bicycle wheels — 26-inch size, which is a standard size available in any cycle shop in India and most countries. Larger wheels roll more easily over bumps and require less effort to keep moving at a steady pace.

Wheel size	26-inch (standard mountain bike size)
Tyre type	Smooth road tyre — less rolling resistance than knobby off-road tyres
Tyre pressure	60-70 PSI — firmer tyres roll with less effort
Front wheels	Spin freely for steering — not connected to the pedal chain
Rear wheels	Connected to the pedal chain — these are the driven wheels that push the car forward
Bearings	Standard cup-and-cone bicycle hub bearings, grease-lubricated

Rear Axle

The two rear wheels attach to a single steel axle rod — a solid steel bar running across the full width of the car. The central chain sprocket sits in the middle of this axle. When the pedal chain turns the sprocket, the axle turns, and both rear wheels turn together.

Differential note

Because both rear wheels are locked to the same axle, they always turn at the same speed. This means tight turns feel stiff — the inside wheel wants to turn slower than the outside one. This is manageable at low speeds but it means this car is best on gentle curves, not sharp city corners. A wider turning circle (about 6 metres) should be expected.

Steering

The front two wheels steer the car. A simple wooden and metal steering column connects to a crossbar linking both front wheels — when the driver turns the steering wheel, both front wheels pivot left or right together. This is the same system used on go-karts and traditional wooden carts.

- Steering wheel: 300 mm diameter, plywood with rubber grip wrap
- Steering column: 25 mm steel tube, runs down to a tie-rod connecting both front wheels
- Turning mechanism: simple kingpin pivots at each front wheel hub — bolt-and-bushing type
- Turning radius: approximately 5-6 metres — plan for wide turns

7. THE PEDAL SYSTEM — FOUR RIDERS, ONE CAR

This is the heart of the car. Each rider has a standard bicycle crankset in front of their seat. All four cranksets feed into a single central shaft through individual chains. That shaft then drives the rear axle through one more chain.

Parts at each rider's station

- One pair of pedals — standard flat platform bicycle pedals
- One crank arm set (left and right arms, 170 mm length)
- One chainring — 44-tooth sprocket, standard bicycle size
- One chain — standard 1/2-inch bicycle chain
- One freewheel (ratchet) — lets the rider stop pedaling without stopping the car
- One connection sprocket on the central shaft — receives the chain from that rider's chainring

The central shaft

A single steel shaft runs left to right across the middle of the car, just below the floor, between the front and rear rows of seats. All four rider chains connect to this shaft through sprockets. At the centre of the shaft, one final chain runs back to the rear axle.

How all four riders connect

Picture four bicycle chains, all arriving at a central spinning rod from different directions. The rod collects all that turning force and sends it out through one chain to the rear wheels. If all four riders pedal steadily, the rod turns smoothly. If one rider stops, the others carry on — their freewheels prevent the idle station from causing any drag.

Gear ratio — how fast does it go?

The gear ratio determines how far the car moves for every full turn of the pedals. A higher ratio means more speed per pedal stroke but requires more effort. This car uses a fixed, simple ratio chosen for comfortable pedaling at 15–20 km/h.

Chainring (rider)	Rear sprocket (axle)	Speed per pedal turn	Comfortable speed (at 70 RPM)
44 teeth	16 teeth	~3.1 metres	~13 km/h
44 teeth	14 teeth	~3.6 metres	~15 km/h
44 teeth	12 teeth	~4.2 metres	~17 km/h

A 14-tooth rear sprocket is recommended as the starting point. It gives a realistic cruising speed of 14–16 km/h for four people pedaling at a comfortable pace — not sprinting, not struggling.

8. HOW FAST WILL IT GO?

This is the most important question and deserves an honest answer. The car moves on human power alone. Human power is limited. At the same time, the car is lightweight and has low friction — so it does not take as much effort as you might think.

Situation	Expected speed	Notes
All four riders pedaling steadily	14 – 18 km/h	Comfortable, sustainable pace for 20–30 minutes
All four riders pedaling	22 – 26 km/h	Tiring after a few minutes

Situation	Expected speed	Notes
hard		
Two riders pedaling, two resting	8 – 12 km/h	Relaxed, very sustainable
One rider only	5 – 8 km/h	Very slow, useful for parking or tight spots
Going downhill (no pedaling)	Up to 30 km/h	Weight + gravity; brakes must be in good condition
Going uphill (gentle slope)	8 – 12 km/h	Requires full effort from all four riders
Going uphill (steep slope)	3 – 5 km/h or stop	May need to get out and push on steep hills

Honest expectation

This car is not fast. It is not meant to be. It is a fun, healthy, social way to travel short distances — think 1 to 5 kilometres on flat roads or gentle paths. It is perfect for campuses, parks, beach promenades, village roads, and tourist areas. It is not suited for highways, steep hills, or heavy traffic.

9. WEIGHT — KEEPING IT LIGHT

Keeping the car light is the single most important engineering goal. A lighter car is faster, easier to pedal uphill, easier to steer, and simpler to stop. Every kilogram added makes the car noticeably harder to move.

Part	Target weight	Material
Wooden frame (beams + panels)	40 kg	Hardwood + marine plywood
Four wheels + tyres	16 kg	26-inch bicycle wheels
Rear axle + front axle	6 kg	Solid steel rod, 25 mm dia.
Pedal system (all 4 stations + chains)	14 kg	Standard bicycle parts
Steering column + linkage	4 kg	Steel tube + plywood wheel
Brakes (pads, cables, levers)	2 kg	Bicycle hydraulic or cable disc
Seats (4 fixed wooden seats with cushion)	8 kg	Plywood + foam pad

Part	Target weight	Material
Roof and weather cover	6 kg	Bent plywood + canvas
Bolts, screws, glue, misc.	4 kg	
TOTAL — empty car	100 kg	Target: under 110 kg
Four adult riders	~280 kg	Assumed 70 kg each
TOTAL — car + four riders	~380 kg	Full load

Weight matters a lot

At 380 kg total, this car needs about the same pedaling effort as four cyclists riding four separate bicycles at the same speed. The car body adds roughly 25-30% more drag and weight compared to bare cyclists. Expect the effort to feel roughly like cycling up a very slight incline at all times — manageable, but real.

10. BRAKES — IN DETAIL

Brakes are the safety-critical part of this car. They must work every time, in wet conditions, on a downhill slope, with 380 kg of loaded car to stop. This is not the place to save money or simplify.

Recommended brake setup

Brake type	Mechanical disc brakes (cable-operated) — standard mountain bike parts
Brake discs	One on each of the four wheels — 160 mm diameter steel disc
Brake calipers	Four — one per wheel, cable-pulled, single-piston
Brake cable run	All four calipers connect to a single foot pedal lever via a splitter cable
Foot lever	Floor-mounted foot pedal at driver's left foot — press down to brake
Handbrake (park)	A hand-pull lever that locks the rear brakes when parked on a slope
Stopping distance (20 km/h)	Approximately 5-7 metres on dry flat road
Stopping distance (30 km/h downhill)	Approximately 12-15 metres — approach descents cautiously
Wet performance	Disc brakes work well in rain — better than rim brakes on wet wheel rims

Brake check — every time before riding

Before each use: press the foot brake and check it feels firm. Check that the car does not move when the brake is held. Check brake pads are not worn down to the metal. Replace pads when less than 2 mm of rubber remains.

11. SEATS & RIDER COMFORT

Four adults pedaling for 20–30 minutes need a comfortable, supportive seat and enough leg room to pedal efficiently. An awkward seat position wastes energy and causes pain.

- Seat base: 12 mm marine plywood, 400 mm wide × 350 mm deep, shaped with a gentle slope
- Backrest: 12 mm plywood, 400 mm tall, angled at 15 degrees back from vertical
- Cushioning: 40 mm closed-cell foam pad on seat and backrest, covered in weather-resistant vinyl
- Seat position: fixed — but the pedal crank arm length (165, 170, or 175 mm) can be chosen to suit rider height when building the car
- Leg room: 950 mm between front and rear row — enough for riders up to 1.85 m tall with legs fully extended
- Entry / exit: each rider lifts a hinged side panel (like a low car door) and steps in
- Seatbelts: lap belt at each position — a simple webbing belt with a clip buckle, bolted through the wooden floor

Pedaling angle matters

The ideal pedaling position has the knee slightly bent (not fully straight) at the bottom of the pedal stroke. If the seat is too close to the pedals, the knees will rise too high and riders tire quickly. If too far, the leg overextends and power is lost. Test with a few different riders when the car is first built.

12. WEATHER COVER & BODY

The body of the car serves two purposes: it keeps riders dry in light rain and wind, and it gives the car a recognisable car-like shape. It is not a structural part — the wooden frame does all the load-bearing work. The body is just a shell attached to the frame.

- Roof: a single curved panel of 3 mm flexible plywood, bent over two wooden arches and screwed in place

- Sides: 3 mm plywood panels, cut to shape, painted or varnished
- Windscreen: a flat sheet of 4 mm polycarbonate (clear plastic) — lightweight, shatter-resistant, cheap
- Rear opening: no boot lid needed — the rear is open or covered with a canvas flap
- Doors: hinged side panels on each side — lift to enter, lower to close — simple hook-and-eye latch
- Paint: exterior wood primer + two coats of outdoor paint or varnish — reapply every 1-2 years
- Drainage: small holes drilled in the floor corners so any rain that gets in drains out

13. MAINTENANCE — KEEPING IT RUNNING

Because every moving part is a standard bicycle component, maintenance is simple and cheap. Any bicycle mechanic can service this car. No special knowledge or tools needed.

Task	How often	How to do it
Oil all four chains	Every 2 weeks or after rain	Drip bicycle chain oil along each chain, wipe excess off
Check tyre pressure	Every week	Use a bicycle pump with a pressure gauge — keep at 60-70 PSI
Check brake pads	Every month	Look at pad thickness — replace if under 2 mm of rubber left
Check brake cable tension	Every month	Brake lever should feel firm, not spongy — tighten cable barrel adjuster if needed
Tighten all bolts	Every 3 months	Go around every bolt and nut with a spanner — wood compresses over time
Check wood joints for cracks	Every 3 months	Look at all glued corners and beam joints — re-glue any gaps immediately
Re-varnish wood surfaces	Once a year	Sand lightly, wipe clean, apply one coat of exterior varnish
Replace chains	Every 2,000-3,000 km	Chains stretch with use — a stretched chain wears out the sprockets
Grease wheel bearings	Once a year	Remove wheels, clean and re-pack hub bearings with waterproof grease

The great advantage of this design

When something breaks on this car, the replacement part costs a few hundred rupees and is available at the nearest bicycle shop. There are no specialised components, no software to update, no battery to replace. A teenager with basic

bicycle knowledge can maintain this car.

14. WHAT THIS CAR CANNOT DO — HONEST LIMITS

Being honest about limitations is part of good design. This car is not trying to replace a motor car. It is solving a different, smaller problem. Here is what it cannot do:

Limitation	Why	What to do instead
Cannot climb steep hills	Human power is limited — a steep slope needs far more force than four people can produce	Plan routes on flat or gently sloping roads only
Cannot go faster than ~26 km/h	This is the practical limit of direct-pedal human power at this weight	Accept it — 20 km/h is perfectly fine for short trips
Cannot carry heavy loads	Extra weight slows the car dramatically	Keep cargo to under 10 kg total
Cannot be used on highways	Unsafe speed gap — motor vehicles travel much faster	Use on dedicated paths, campuses, parks, and quiet roads only
Cannot drive in heavy rain comfortably	The body offers partial cover but is not fully sealed	Use in dry weather or light drizzle; avoid heavy rain
Cannot carry more than 4 riders	Frame and seating designed for four only — overloading is dangerous	Strictly limit to four people
Cannot replace a car for daily commuting	Speed and range (2-5 km) are too low for most commutes	Use for short-distance leisure, tourism, and campus travel

15. WHERE THIS CAR EXCELS

Within its honest limits, this car is genuinely excellent. It is fun, social, healthy, zero-emission, nearly silent, and requires no fuel or electrical charging. Here are the situations where it works beautifully:

- University and school campuses — moving between buildings on flat ground
- Eco-tourism — scenic rides through parks, heritage areas, beach promenades

- Resorts and holiday parks — guest transport around the property
- Amusement parks and fair grounds — family experience rides
- Market areas and pedestrian zones — slow-moving, people-friendly transport
- Villages and small towns — flat terrain, short distances, low traffic
- Film and event sets — props, behind-the-scenes transport, zero emissions on set
- Schools — a working STEM project that students can actually ride

The best version of this car

Is used on a 2 km flat circuit inside a campus or resort. Four friends pedal it on a sunny morning. It moves at 16 km/h. Everyone is laughing. It costs almost nothing to run. It broke down once — a chain slipped — and the nearest bicycle mechanic fixed it in 20 minutes for ₹150. That is exactly what this car is designed to be.

16. HOW MUCH IT COSTS TO BUILD

The following is an estimated cost for building one car in India using locally available materials and standard bicycle parts. Prices are approximate and may vary by region.

Item	Quantity	Estimated Cost (INR)
Hardwood (teak or ash) — beams	20 metres	₹ 6,000 - 9,000
Marine plywood (12 mm) — floor + seats	3 sheets (8×4 ft)	₹ 5,400 - 7,500
Marine plywood (3 mm) — body panels	4 sheets (8×4 ft)	₹ 3,200 - 5,000
26-inch bicycle wheels (complete with tyres)	4 wheels	₹ 4,000 - 7,000
Bicycle cranksets + pedals	4 sets	₹ 3,200 - 5,600
Bicycle chains	5 chains (4 riders + 1 axle)	₹ 1,500 - 2,500
Sprockets and freewheels	8 pieces	₹ 2,400 - 4,000
Rear steel axle (25 mm rod, cut to 1.4 m)	1 piece	₹ 800 - 1,200
Disc brakes (calipers, discs, cables)	4 sets	₹ 4,000 - 7,000
Steering column, tube, tie rod	1 set	₹ 1,200 - 2,000
Polycarbonate windscreen sheet	1 sheet	₹ 1,500 - 2,500
Seat foam pads + vinyl cover	4 seats	₹ 2,400 - 4,000
Wood glue, bolts, screws, varnish,	Assorted	₹ 2,000 - 3,500

Item	Quantity	Estimated Cost (INR)
paint		
Seatbelts (lap belt type)	4 belts	₹ 1,200 - 2,000
Labour (carpentry + bicycle assembly)	~60 hours	₹ 6,000 - 12,000
TOTAL ESTIMATED BUILD COST		₹ 45,000 - 75,000

Cost in perspective

At ₹45,000-75,000 to build, this car costs roughly the same as a good quality bicycle for each of the four riders — except all four share one vehicle together. Running costs are almost zero — chain oil once a fortnight, occasional brake pads. There is no fuel bill, no insurance (for private/campus use), no battery to replace, ever.

17. FINAL THOUGHTS

This car will not win a speed race. It will not climb a mountain. It will not replace the family car. But it will do something no petrol car or electric car can do — it will make four people laugh together while they power their own journey with their own bodies, sitting inside something they could build themselves from materials they can find anywhere.

It is slow, simple, honest, and joyful. In a world of complicated machines, that is not a small thing.

The car in one sentence

A wooden four-seat car where your legs are the engine, your feet are the brakes, and a chain is the gearbox — built from timber and bicycle parts, fixed with a spanner, and powered by nothing but people.

— End of Study —